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FOREST INSECT CONDITIONS

in the Pacific Northwest during 1958

by
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and
P. W. ORR

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
U. S. DEPT. OF AGRICULTURE • FOREST SERVICE

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This is the 11th in a series of annual reports of forest insect conditions in Oregon and most of Washington, as revealed by cooperative surveys. These surveys were made by many persons, all of whose efforts were helpful and much appreciated. Special acknowledgment is made to the principal cooperators: Oregon State Board of Forestry, Washington State Department of Natural Resources, and Weyerhaeuser Timber Co. Other cooperators are listed in the appendix. (Note: A part of northeastern Washington is not included in this report. Conditions in Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties are surveyed and reported by the Missoula, Mont., Forest Insect Laboratory, a unit of the Intermountain Forest and Range Experiment Station, Ogden, Utah.)

COVER BACKGROUND: Egg galleries and larval mines of the silver fir beetle, Pseudohylesinus grandis Sw.

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Division of Forest Insect Research

May 1959

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
R. W. Cowlin, Director Portland, Oregon

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SURVEY FINDINGS IN BRIEF

In general, 1958 was a better-than-average year for the forest manager in his efforts to hold insects in check in the Pacific Northwest. Outbreaks totaled slightly more than 2 million acres (table 1). The extent and intensity of outbreaks by insect species are given in detail in table 17 for Oregon and in table 18 for Washington. Locations of the most important outbreaks are shown in figures 2 and 3. (Tables 17 and 18 and figures 2 and 3 are located in the appendix.)

Principal findings of the 1958 survey were as follows:

1. The spruce budworm, balsam woolly aphid, Douglas-fir beetle, mountain pine beetle, and western pine beetle accounted for most of the epidemic acreage.

2. Outbreaks of the following insects increased:

   a. Douglas-fir beetle.--Tree killing from attacks in 1957 and 1958 was severe in southern Oregon. Attacks in 1959 are expected to decline.

   b. Mountain pine beetle.--The extent of infestations increased in western white pine, ponderosa pine, and sugar pine, but decreased in lodgepole pine.

   c. Western pine beetle.--Tree killing increased generally in both States, becoming moderately to heavily epidemic in a few places.

   d. Silver fir beetles.--Tree killing in this infestation, rated light epidemic, increased in northern Washington.

   e. Fir engraver.--Losses were principally in subalpine stands and about equally distributed between the two States.

Table 1.--Summary of 1958 forest insect epidemic infestations in Oregon and Washington

Insects[1]	Oregon		Washington[2]		Regional total	
	Infestation centers	Area	Infestation centers	Area	Infestation centers	Area
	Number	Acres	Number	Acres	Number	Acres
Defoliators:						
Spruce budworm	84	315,440	0	0	84	315,440
Larch bud moth	0	0	45	41,920	45	41,920
Spruce bud moth	14	4,800	1	480	15	5,280
Black-headed budworm	0	0	9	2,720	9	2,720
Pandora moth	1	1,600	0	0	1	1,600
Lodgepole pine sawfly	1	320	0	0	1	320
Ponderosa pine needle miner	1	160	0	0	1	160
All defoliators	101	322,320	55	45,120	156	367,440
Sucking insects:						
Balsam woolly aphid	111	110,560	75	145,760	186	256,320
Pine needle scale	0	0	7	10,400	7	10,400
All sucking insects	111	110,560	82	156,160	193	266,720
Bark beetles:						
Douglas-fir beetle	672	880,160	118	51,320	790	931,480
Mountain pine beetle (W)	67	32,160	486	190,880	553	223,040
Mountain pine beetle (L)	58	36,640	11	5,920	69	42,560
Mountain pine beetle (P)	4	2,560	0	0	4	2,560
Western pine beetle	78	96,640	91	56,080	169	152,720
Engelmann spruce beetle	9	4,640	14	3,840	23	8,480
Fir engraver	35	11,120	46	10,880	81	22,000
Oregon pine ips	43	7,680	16	3,320	59	11,000
Silver fir beetles	0	0	25	4,720	25	4,720
All bark beetles	966	1,071,600	807	326,960	1,773	1,398,560
All insects	1,178	1,504,480	944	528,240	2,122	2,032,720

1/ Mountain pine beetle infestations are separated by tree species: L, lodgepole pine; P, ponderosa pine; W, western white pine.

2/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

f. Larch bud moth. --Defoliation of western larch in the Cascade Range of Washington increased somewhat.

g. Pine needle scale. --On ponderosa pine adjacent to orchards near Wenatchee, Wash., damage was more conspicuous.

3. Outbreaks of the following insects decreased:

a. Spruce budworm. --The epidemic infestations were the lowest they had been during the period of detailed records, beginning in 1947.

b. Balsam woolly aphid. --Killing by the aphid decreased for the first year since discovery of the outbreak in 1954, but a population increase late in the season indicated that losses of timber were likely to rise again soon.

c. Spruce bud moth. --The outbreak of 1957 in coastal forests subsided without causing appreciable damage.

d. Black-headed budworm. --The extensive outbreak that flared up suddenly in 1957 in the Cascade Range of Washington practically disappeared.

e. Oregon pine ips. --Damage by this insect was the least in many years.

f. Engelmann spruce beetle. --Losses decreased considerably and totaled about the same acreage in both States.

4. New outbreaks of the following insects were found:

a. Pandora moth. --A flareup of subepidemic intensity developed on ponderosa pine on the Deschutes National Forest in Oregon--the first recorded outbreak in many years.

b. Lodgepole pine sawfly. --A small infestation appeared in an isolated stand of lodgepole pine on the Willamette National Forest in Oregon.

c. Ponderosa pine needle miner.--Considerable feeding on ponderosa pine on the Fremont National Forest in Oregon was noted early in the season but the damage became inconspicuous later.

d. Other insects noted in abnormal numbers were sawflies on Douglas-fir, noble fir, and other true firs; a weevil on noble fir; and several seed and cone insects.

PRINCIPAL INSECTS

The outbreaks reported in this section are of present or potential economic importance. In general, they caused damage conspicuous and extensive enough to be observed and mapped from the air.

Defoliators

SPRUCE BUDWORM
Choristoneura fumiferana (Clem.)

The epidemic outbreaks that began in 1944 are still in progress, but are less extensive than at any time since 1947, when detailed records were begun (fig. 1).

In 1958, spraying covered 818,000 acres of threatening epidemic infestations, bringing the total area sprayed since 1949 to 4,658,000 acres. Average mortality in 1958 was 96.2 percent, achieved at a cost of $0.69 per acre.

The regional survey revealed residual populations on the Ochoco, Malheur, and Wallowa-Whitman National Forests in the Blue Mountains of Oregon. Four new, light epidemic centers appeared in unsprayed areas of eastern Oregon. One was on the Deschutes National Forest in the Fly Creek drainage; the other three were on the Fremont National Forest in the Dairy Creek and Kelly Creek drainages and on the east slopes of Rogger Peak (table 2).

Defoliation by the 1957-58 brood increased in extent and severity on the Snake, Joseph, and Pine Creek units of the Wallowa-Whitman National Forests. Elsewhere, practically all defoliation was of light intensity.

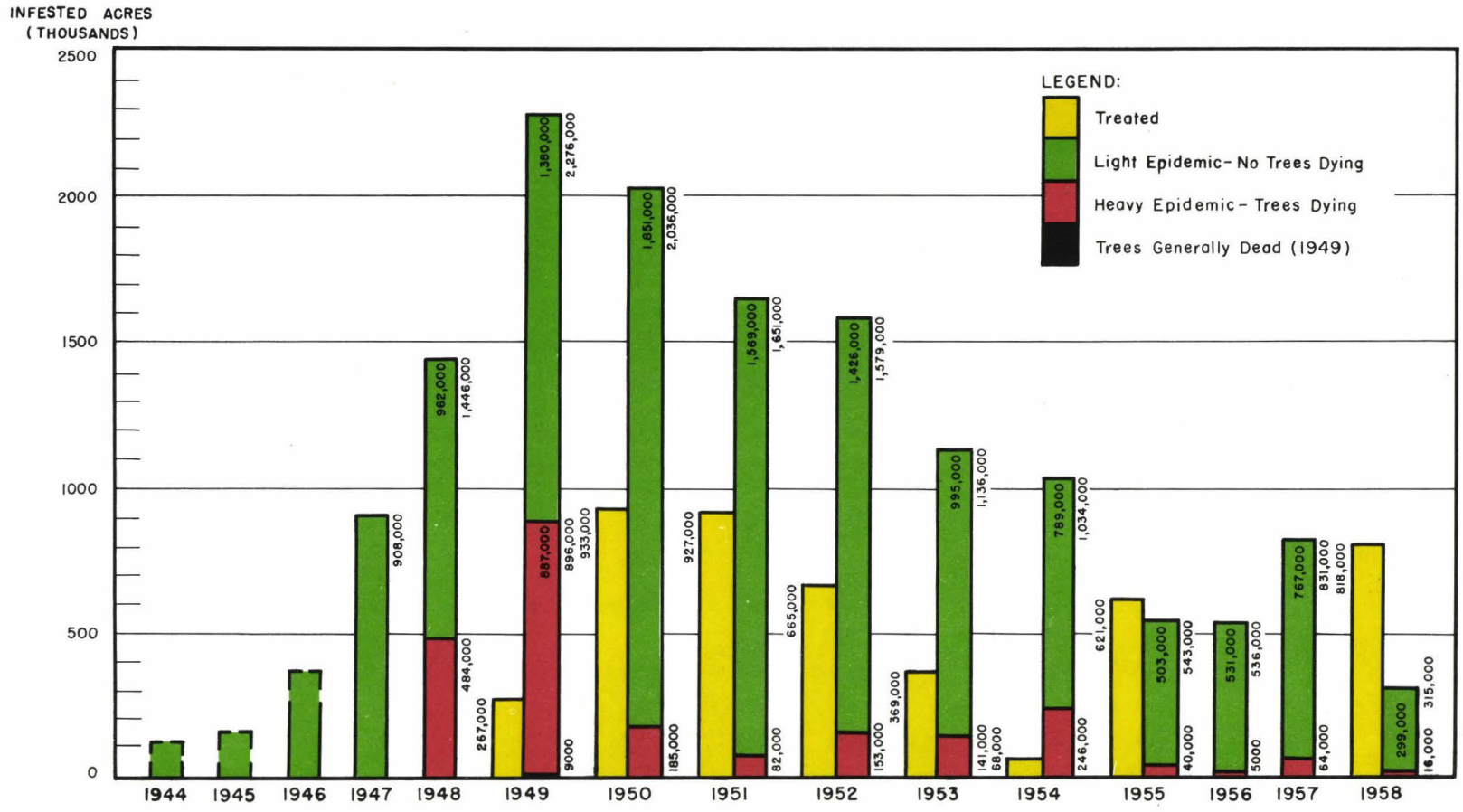


Figure 1.--Progress of the spruce budworm epidemic in Oregon and Washington, 1944-58.

Table 2.--Extent of spruce budworm infestations in Oregon in 1958, by control unit and intensity of infestation

(In acres)

Administrative area[1] and control unit	Intensity of infestation			All intensities
	Light	Moderate	Heavy	
Ochoco N.F.:				
Snow Mountain	6,400	0	0	6,400
Malheur N.F.:				
Aldrich Mountain	1,280	640	0	1,920
West Myrtle Butte	2,600	0	0	2,600
King Mountain	8,960	0	0	8,960
Wolf Mountain	4,960	0	0	4,960
Frazier Point	4,000	0	0	4,000
Antelope Mountain	3,320	0	0	3,320
Total	25,120	640	0	25,760
Wallowa-Whitman N.F.:				
Silver Butte	4,000	0	0	4,000
Bald Ridge	3,680	0	0	3,680
Joseph	32,480	34,240	1,600	68,320
Snake	76,160	23,360	12,800	112,320
Moss Spring	2,320	0	0	2,320
Pine Creek	48,800	960	0	49,760
Total	167,440	58,560	14,400	240,400
Lookout Mountain (B.L.M.):				
Lookout Mountain	0	0	2,000	2,000
Deschutes N.F.:				
Fly Creek	2,080	0	0	2,080
Fremont N.F.:				
Dairy Creek	35,440	0	0	35,440
Rogger Peak	1,600	0	0	1,600
Kelly Creek	1,760	0	0	1,760
Total	38,800	0	0	38,800
All units	239,840	59,200	16,400	315,440

[1] N.F., national forest; B.L.M., Bureau of Land Management.

In the fall, a special survey was made of the major centers of infestation to determine the status of the budworm populations that will feed in 1959 (table 3). The number of new and old egg masses per 1,000 square inches of foliage was used as a basis for determining population and trend. In general, the budworm population is declining and serious damage is not expected in 1959. At two localities--one on the Fremont and one on the Wallowa-Whitman National Forests--the trend is slightly upward and should be watched carefully in 1959.

No further spraying is planned in the near future since natural forces are effecting satisfactory control.

LARCH BUD MOTH
Zeiraphera griseana (Hübner)

Western larch was defoliated on extensive areas in Washington, especially on the Okanogan, Wenatchee, and Snoqualmie National Forests and the Yakima and Colville Indian Reservations.

This insect periodically becomes epidemic on larch over large areas. It also attacks Douglas-fir, true firs, and Engelmann spruce. Outbreaks to date have been of short duration. The defoliated trees often put out new needles after the bud moth has completed feeding, and tree killing is generally insignificant, although annual increment may be reduced to some extent by repeated defoliations. Direct control is considered unnecessary.

The present trend is upward. Subepidemic populations on Douglas-fir and white fir in both eastern and western Oregon have continued to be light and are causing no appreciable damage.

SPRUCE BUD MOTH
Zeiraphera ratzeburgiana Sax.

The extensive outbreaks in Sitka spruce stands along the Oregon and Washington coast declined to a few, small, spot infestations on the Siuslaw National Forest in Oregon and on the Olympic National Forest in Washington. The downward trend is expected to continue in 1959.

Table 3.--Density of 1958 spruce budworm egg populations and population trends at 18 points in Oregon

Administrative area[1] and sampled locality	Egg masses per 1,000 sq.in. of foliage		Class of density, 1958 level[2]	Trend
	New	Old		
	------ Number ------			
Deschutes N.F.:				
Green Ridge	0.0	0.0	Very low	Down
Fremont N.F.:				
Picture Flat	.7	2.2	"	"
Coleman Ridge	4.4	4.1	Low	Up
Malheur N.F.:				
King Mountain, No. 1	.7	3.7	Very low	Down
King Mountain, No. 2	.4	.6	"	"
Ochoco N.F.:				
Alder Springs	.2	.9	"	"
Snow Mountain	.1	1.2	"	"
Wallowa-Whitman N.F.:				
Baker	.3	1.0	"	"
Sumpter-Tipton	.1	2.3	"	"
Duck Creek, No. 1	1.7	6.3	"	"
Duck Creek, No. 2	.3	1.6	"	"
Fish Lake, No. 1	1.4	2.2	"	"
Fish Lake, No. 2	1.2	1.3	"	(3/)
Joseph-Lick Creek	.7	6.1	"	Down
Joseph-Nesbitt Butte	.7	3.2	"	"
Joseph-Harl Butte	.6	6.9	"	"
Joseph-Gumboot Butte	.8	2.2	"	"
Imnaha-Hat Point	4.2	4.6	Low	(3/)

1/ N.F., national forest.

2/ Very low, 0.0 to 2.0; low, 2.0 to 4.5; moderate, 4.5 to 9.0.

3/ Uncertain.

BLACK-HEADED BUDWORM
Acleris variana (Fern.)

The first extensive outbreak of this insect in the Washington Cascades began in 1957 and subsided to a few spot infestations on the Snoqualmie and Gifford Pinchot National Forests in 1958. In this outbreak western hemlock was the preferred host, but true firs and Douglas-fir were also attacked. In eastern Oregon, subepidemic populations of the budworm, too light to be detected from the air, were present on subalpine fir on the Umatilla National Forest and on Engelmann spruce on the Wallowa-Whitman National Forests. Elsewhere, light populations occurred on Douglas-fir and white fir.

In western Washington, research studies showed that egg sterility accounted for a 30-percent reduction of brood. Larval populations were reduced 54 percent by parasites and 32 percent by other causes, chiefly a microsporidian disease.

In eastern Oregon, similar population reductions at spots on the Umatilla National Forest were attributed to insect parasites and disease was not a major control factor in this area. At other points in eastern Oregon, late-season pupal populations indicated that a slight buildup may occur in 1959.

PANDORA MOTH
Coloradia pandora Blake

A moth flight near Sisters, Oreg., in August provided the first opportunity in about 25 years to study the biology and natural control of this periodic defoliator of ponderosa pine. Eggs were deposited in August and hatched early in September, and the larvae fed gregariously until mid-October. At that time the larvae dispersed and began feeding individually and occasionally in groups of two to four. These immature larvae overwinter on the needles and commence feeding again the next spring. Upon reaching maturity the larvae drop to the ground and pupate for 1 full year.

Damage to foliage was light this year but it is expected to increase as the larvae reach maturity in 1959.

So far the incidence of parasitism has been low. When the larvae drop to the ground to pupate, predation by rodents should

reduce the population considerably. The trend of this light infestation is uncertain at present.

LODGEPOLE PINE SAWFLY
Neodiprion sp.

One small spot of 320 acres of light infestation appeared on the Willamette National Forest in Oregon. Experience shows that even on severely defoliated areas little tree mortality results. The trend is apparently upward, but the host tree--lodgepole pine--is limited in extent in this particular area.

PONDEROSA PINE NEEDLE MINER
Argyresthia sp.

Larvae of this unidentified needle miner killed much of the old foliage of ponderosa pine on 160 acres in the Warner District, Fremont National Forest. Some fear was felt that the trees might be killed, or at least weakened so much they would be prey to bark beetles. However, new needles developed normally, and by the end of the season the trees had recovered with little sign of lasting harmful effects.

Sucking Insects

BALSAM WOOLLY APHID
Chermes piceae (Ratz.)

The extent and intensity of damage caused by this aphid declined early in the season for the first time since discovery of the outbreak in 1954 (table 4). However, aggressive bole infestations became prevalent on subalpine fir in the Cascade Range in the two States late in the season, indicating that the epidemic may increase in these areas in 1959. Severe mortality of merchantable Pacific silver fir has occurred. Mortality was also severe in subalpine fir stands on recreational and watershed areas.

The bulk of the damage in Oregon occurred in subalpine fir stands on the Willamette and Mount Hood National Forests (table 5). Tree killing also continued in mature Pacific silver fir stands in the

Table 4.--Trend of balsam woolly aphid infestations in Oregon and Washington, 1954-58

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1954	0	129,920	129,920
1955	35,680	258,880	294,560
1956	152,210	203,780	355,990
1957	385,200	214,560	599,760
1958	110,560	145,760	256,320

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

vicinity of Black Rock, Oreg., adjacent to the Siuslaw National Forest. Much of the overstory in this area is dead and understory trees are severely infested.

In Washington, the heaviest damage continued in the Green, Toutle, and Kalama River drainages on the Gifford Pinchot National Forest, but considerable tree recovery was noted in the Lewis River area south of Mount St. Helens. The aphid was detected in the Stevens Canyon area of Mount Rainier National Park, marking the northernmost point it has been found in Washington.

The predicted trend for 1959 is upward in subalpine fir stands and static or slightly downward in Pacific silver fir stands in the region.

Research on the balsam woolly aphid was given high priority in 1958. Six species of insect predators were imported from Europe and Asia and released in the Northwest in a study of the possibilities of biological control. Two species of introduced predators have become at least temporarily established. Also, a number of native predators have been found. Most of these vary in abundance from area to area and from tree to tree; they appear to be most effective when the aphid population is high.

Table 5.--Extent of balsam woolly aphid infestations in 1958, by administrative area and intensity of infestation

Administrative area[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very Heavy	
	Number	Acres				
Oregon:						
Willamette N.F.	41	42,880	12,640	0	0	55,520
Mt. Hood N.F.	59	20,800	8,800	0	0	29,600
Siuslaw N.F.	1	7,520	10,560	480	0	18,560
Warm Springs I.R.	5	2,080	480	0	0	2,560
Umpqua N.F.	2	2,240	0	0	0	2,240
Deschutes N.F.	4	2,080	0	0	0	2,080
Oregon areas	112	77,600	32,480	480	0	110,560
Washington:						
Gifford Pinchot N.F.	56	72,290	34,010	15,140	4,960	126,400
SW. Washington (W.S.D.N.R.)	10	12,480	320	0	0	12,800
Snoqualmie N.F.	8	6,080	0	0	0	6,080
Wenatchee N.F.	1	480	0	0	0	480
Washington areas	75	91,330	34,330	15,140	4,960	145,760
All areas	187	168,930	66,810	15,620	4,960	256,320

1/ Areas include damage on lands of all ownerships.

2/ N.F., national forest; I.R., Indian reservation; W.S.D.N.R., Washington State Department of Natural Resources.

PINE NEEDLE SCALE
Phenacaspis pinifoliae (Fitch)

Infestations spread and became more numerous than usual on ponderosa pine in the vicinity of Leavenworth and Ardenvoir on the Wenatchee National Forest. These infestations have been observed for several years and have been attributed to reduction of natural predators caused by spray drift from surrounding orchards. Other light outbreaks appeared on ponderosa pine on the Colville Indian Reservation, Warm Springs Indian Reservation, and Rogue River National Forest. Minor infestations on lodgepole pine were recorded on the Deschutes National Forest in the vicinity of

Pringle Falls. In these areas, damage is more prevalent along dusty roads and immediately adjacent to mixing plants for road asphalt. The outbreaks appear to be increasing regionwide.

Bark Beetles

DOUGLAS-FIR BEETLE
Dendroctonus pseudotsugae Hopk.

The Douglas-fir beetle was epidemic in in two areas: one, in southwestern Oregon; the other, in north-central Washington (table 6). Elsewhere in the region, there was a general increase in the number of individual trees and small groups attacked by the beetle.

Epidemic outbreaks occurred from Lincoln County, Oreg., south into northern California, with the most severe centers located in the Umpqua River drainage and adjacent stands on the Rogue River National Forest. Considerable tree killing also occurred on the Siskiyou and Siuslaw National Forests.

The north-central Washington centers of infestation were smaller, but the beetles were aggressive. Small outbreaks of light and moderate intensity were present in the Twisp and Methow River drainages on the Okanogan National Forest. On the Colville Indian Reservation, infestations ranging from light to heavy in intensity appeared once again in the Nine Mile Creek and Gold Creek drainages.

The current epidemic in southwestern Oregon resulted from beetle populations that bred in trees that were windthrown in the winter of 1955-56. These trees were attacked in the spring of 1956 and produced broods that emerged in the spring of 1957. The new adults attacked surrounding green trees, causing extensive fading that year and early in the spring of 1958.

In southwestern Oregon a special assessment survey was made in 1958 to determine the status of populations and the probable trend for 1959. A total of 101 groups of trees recently beetle killed were examined and the ratio of 1958 to 1957 mortality was obtained to determine the trend of the outbreak. Also, 9.2 miles of cruise line, one-half chain wide, was run through all intensities of damage to obtain similar data. There was a significant increase in 1958

Table 6.--Extent of Douglas-fir beetle infestations in 1958, by administrative area and intensity of infestation

Administrative area[1/ 2/]	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	All intensities
	Number	Acres				
Oregon:						
Umpqua N.F.	167	175,680	106,400	34,240	1,920	318,240
Siskiyou N.F.	195	172,480	40,960	6,240	1,440	221,120
Rogue River N.F.	121	108,160	38,080	15,520	4,480	166,240
Siuslaw N.F.	108	110,880	23,840	5,760	0	140,480
Umatilla N.F.	28	7,200	6,880	0	0	14,080
Mt. Hood N.F.	15	4,640	2,880	0	0	7,520
Willamette N.F.	16	6,240	160	0	0	6,400
Wallowa-Whitman N.F.	11	1,920	2,400	0	0	4,320
Malheur N.F.	5	640	0	0	0	640
NW. Oregon (O.S.B.F.)	4	640	0	0	0	640
Ochoco N.F.	1	320	0	0	0	320
Warm Springs I.R.	1	160	0	0	0	160
Oregon areas	672	588,960	221,600	61,760	7,840	880,160
Washington:						
Colville I.R.	50	8,120	19,040	1,600	0	28,760
Okanogan N.F.	22	8,320	800	0	0	9,120
Wenatchee N.F.	26	3,520	2,560	160	0	6,240
Umatilla N.F.	7	4,160	0	0	0	4,160
Gifford Pinchot N.F.	7	1,440	0	0	0	1,440
Snoqualmie N.F.	2	960	0	0	0	960
Mt. Baker N.F.	2	320	0	0	0	320
Olympic N.F.	1	160	0	0	0	160
Yakima I.R.	1	160	0	0	0	160
Washington areas	118	27,160	22,400	1,760	0	51,320
All areas	790	616,120	244,000	63,520	7,840	931,480

1/ Areas include damage on lands of all ownerships.

2/ N.F., national forest; I.R., Indian reservation; O.S.B.F., Oregon State Board of Forestry.

mortality over that of 1957 on the Umpqua, Rogue River, and Siskiyou National Forests. On the Siuslaw National Forest there was no significant trend, but the losses appeared to be static or slightly lower in 1958. Beetle brood production in 1958 was generally lighter on all areas, indicating a probable downward trend of tree killing for 1959.

The trend of losses in the region from 1955 through 1958 is shown in table 7. The heavy windthrow of December 1958, most of which is apparently in southwestern Washington, may serve to produce beetle broods that will become aggressive in 1960.

Considerable salvage logging to reduce beetle populations is underway. Continued efforts along this line are needed on areas of recent damage to recover timber values that would otherwise be lost through deterioration. Salvage of the recent windthrow is especially needed to reduce the likelihood of an epidemic population developing and spreading to green timber.

Table 7.--Trend of Douglas-fir beetle infestations in Oregon and Washington, 1951-58

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1951	132,800	35,200	168,000
1952	4,111,730	458,400	4,570,130
1953	4,153,900	678,900	4,832,800
1954	4,440,540	631,210	5,071,750
1955	640,160	232,960	873,120
1956	20,770	96,130	116,900
1957	10,880	7,520	18,400
1958	880,160	51,320	931,480

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

MOUNTAIN PINE BEETLE
Dendroctonus monticolae Hopk.

Epidemic outbreaks increased about 20 percent over last year's on a regionwide basis (table 8). The bulk of this increase occurred in western white pine stands in Washington. A decrease in lodgepole pine and sugar pine mortality and an increase of mortality in young ponderosa pine stands occurred in both States. The situation by tree species follows:

Western white pine.--The greatest increase was on the Mount Baker, Snoqualmie, and Gifford Pinchot National Forests in Washington, and on the Willamette National Forest in Oregon. In most of its range in both States, western white pine is infected with blister rust. The rust and beetle are most destructive to trees just reaching merchantable size, and this lethal combination of pests makes the management of western white pine in this region a costly undertaking of doubtful success.

Lodgepole pine.--Beetle activity in older infestation centers decreased for the third consecutive year, due in large part to fewer susceptible-sized host trees. The largest concentration of damage was on the Deschutes National Forest at Wanoga Butte. An outbreak in the Buck Lake area of the Rogue River National Forest has run its course and is subsiding.

Ponderosa pine.--Damage increased in extent and severity in pole-sized ponderosa pine stands on the Deschutes and Fremont National Forests and on the Klamath Indian Reservation.

Sugar pine.--A general increase in the amount of mature sugar pine killed by the mountain pine beetle occurred on the Umpqua, Rogue River, and Siskiyou National Forests in southern Oregon. Although this condition is subepidemic, careful watch should be kept for further possible increases in 1959.

Table 8.--Trend of mountain pine beetle infestations in Oregon and Washington, by host species, 1955-58[1/]

(In acres)

Year of detection	Area of epidemic infestations						Regional total all species
	Oregon				Washington[2/]		
	W	L	P	S	W	L	
1955	12,110	52,410	2,060	0	81,120	27,240	174,940
1956	34,680	52,420	7,440	0	130,180	28,040	252,760
1957	29,280	73,920	640	160	102,560	5,440	212,000
1958	32,160	36,640	2,560	0	190,880	5,920	268,160

1/ Host species are: W, western white pine; L, lodgepole pine; P, ponderosa pine; S, sugar pine.

2/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

WESTERN PINE BEETLE
Dendroctonus brevicomis Lec.

The regionwide increase noted in 1957 continued in 1958 (table 9). Generally the infestations were subepidemic and light epidemic in intensity, but on local areas they ranged from moderately to heavily epidemic. The grouping of attacks, characteristic of severe outbreaks, became more evident.

In Oregon, the largest increases occurred on the Snow Mountain District of the Ochoco National Forest, in the Dry Creek drainage of the Fremont National Forest, and in the Metolius Bench area of the Warm Springs Indian Reservation. Elsewhere tree killing was subepidemic but increasing. Aggressive infestation centers in Washington were found on the Okanogan National Forest, and on the Yakima, Colville, and Spokane Indian Reservations.

Control of the pine beetle by sanitation-salvage logging is in progress or is planned for most of the heaviest centers of infestation. The only direct control work against the beetle was done along the south entrance road to Crater Lake National Park, where the Park Service treated five trees with ethylene dibromide.

Table 9.--Trend of western pine beetle infestations in Oregon and Washington, 1955-58

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1955	31,560	13,760	45,320
1956	13,920	2,110	16,030
1957	39,040	2,720	41,760
1958	96,640	56,080	152,720

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

ENGELMANN SPRUCE BEETLE
Dendroctonus engelmanni Hopk.

Epidemic infestations declined (table 10). The few remaining centers were in subalpine stands on the Wenatchee and Umatilla National Forests. Beetle broods were generally light, indicating a downward trend for 1959. Salvage is in progress, but is hampered because of low timber values and limited access.

Table 10.--Trend of Engelmann spruce beetle infestations in Oregon and Washington, 1955-58

(In acres)

Year of detection	Area of epidemic infestation		Regional total
	Oregon	Washington[1/]	
1955	1,940	20,640	22,580
1956	11,160	3,720	14,880
1957	24,480	7,680	32,160
1958	4,640	3,840	8,480

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

FIR ENGRAVER
Scolytus ventralis Lec.

Losses caused by this beetle increased slightly (table 11). The damage occurred mainly in subalpine stands on the Wenatchee and Okanogan National Forests in Washington and on the Umatilla and Wallowa-Whitman National Forests in Oregon.

The heaviest mortality again occurred on the Umatilla National Forest in Oregon, with the largest concentrations in the Langdon Lake area. In this area, the true firs are being killed by the beetle and a root rot fungus. Control is impractical.

Table 11.--Trend of fir engraver infestations in Oregon and Washington, 1955-58

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1955	31,160	19,360	50,520
1956	19,200	5,760	24,960
1957	9,920	11,360	21,280
1958	11,120	10,880	22,000

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

OREGON PINE IPS
Ips oregoni (Eichh.)

Damage to young ponderosa pine stands caused by this insect declined for the second successive year (table 12). The centers of heaviest damage in Oregon were in fringe stands in the vicinity of Grants Pass, Oreg. East of the Cascade Range in Oregon, damage was of no great importance and was widely scattered. In Washington, centers of light epidemic intensity were found in fringe stands of the Colville Indian Reservation, west of Nespelem, Wash.

Proper handling of logging and thinning slash offers the most practical means of keeping losses to a minimum. Direct control is seldom, if ever, warranted.

Table 12.--Trend of Oregon pine ips infestations in Oregon and Washington, 1955-58

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1955	46,950	4,960	51,910
1956	82,720	9,220	91,940
1957	26,880	1,760	28,640
1958	7,680	3,320	11,000

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

SILVER FIR BEETLES
Pseudohylesinus spp.

Light epidemic outbreaks of silver fir beetles[1/] increased on the Mount Baker and Snoqualmie National Forests in Washington (table 13). Although tree killing generally was far short of that experienced during the recent severe epidemic, the apparent upward trend warrants close watching.

In 1958, private, State, and Federal cooperators examined 275 trend plots established in 1954 in the Mount Baker and Olympic Peninsula areas to observe annual mortality of Pacific silver fir and western hemlock. On the plots in the Mount Baker area the vigor of Pacific silver fir declined, and tree mortality resulting from bark beetles, disease, windthrow, and unknown causes increased to 12.5 percent of the stand. In the Olympic area, mortality of Pacific silver fir was negligible and the condition of the green trees continued to be good.

1/ "Silver fir beetles" is a local name given to two species of Pseudohylesinus: P. grandis Sw., the grand fir bark beetle; and P. granulatus (Lec.), the fir root bark beetle.

No effective control measures have been developed for these insects, which are primarily destructive in overmature and decadent stands. The only practical action is to utilize the timber on affected areas where tree killing has begun or is imminent.

Table 13.--Trend of silver fir beetle infestations in Oregon and Washington, 1949-58

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1949	0	38,000	38,000
1950	0	55,000	55,000
1951	0	243,000	243,000
1952	0	[2/]162,440	162,440
1953	0	543,840	543,840
1954	16,390	635,840	652,230
1955	4,320	110,400	114,720
1956	0	0	0
1957	0	1,120	1,120
1958	0	4,720	4,720

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

[2/] Survey incomplete.

OTHER INSECTS

Many forest insects other than those discussed have caused extensive damage in the past, and some may cause serious damage in the future. For this reason, it is desirable to follow the trend of these insects so that any increase will be noted and reported promptly.

Brief statements on the status of some of these insects in 1958 follow. None of the insects require control at present.

Defoliators

Douglas-Fir Tussock Moth
(Hemerocampa pseudotsugata McD.)

Some very light feeding was observed in August on Douglas-fir near Hat Point on the Wallowa-Whitman National Forests. Near Woodland, Wash., one tree was totally defoliated. Examination of current egg masses from this tree indicated a heavy egg parasitism by a small hymenopteron. The Woodland infestation is of interest because it occurred in the Douglas-fir region, an area in which the tussock moth has not been found in epidemic numbers in the forest, despite its destructiveness east of the Cascade Range.

Western Hemlock Looper
(Lambdina fiscellaria lugubrosa Hulst)

In 1958 this looper was reported in eastern Oregon for the first time. Several larvae were taken from white fir in the vicinity of Joseph and along the Imnaha River on the Wallowa-Whitman National Forests. No appreciable damage to the trees was noted.

Western Oak Looper
(Lambdina fiscellaria somniaria Hulst)

Infested Oregon white oak was detected near Springfield, Oreg., and at other widely scattered points in the Willamette Valley. An oak stand in the city park at Centralia, Wash., was also attacked. The feeding causes no permanent damage since the oaks are able to leaf out again the following year. In the past, outbreaks of the oak looper have occurred about the same time as have those of the hemlock looper in coastal forests, hence special search for the latter insect in the next few years is warranted.

Spruce Tip Moth
(Griselda radicana (Wlsm.))

The occurrence of this moth in Douglas-fir and white fir stands in eastern Oregon was spotty, and damage resulting from its feeding was minor. In most areas where it was found, it was outnumbered by the spruce budworm.

Unknown Moth
Family Saturniidae

A group of ponderosa pines on Dooley Mountain on the Wallowa-Whitman National Forests was lightly defoliated by larvae that closely resembled the pandora moth. The defoliation was visible on both large and small trees. The area in which this damage occurred was sprayed during the 1958 spruce budworm project.

Fir Sawfly
(Neodiprion sp.)

Noble fir at the headwaters of the Clackamas River on the Mount Hood National Forest was fed upon to the point that cutters of Christmas greens expressed some concern. Elsewhere in the region sawfly feeding on true firs was more pronounced than in 1957, but was still not epidemic.

Douglas-Fir Sawfly
(Neodiprion sp.)

Several acres of Douglas-fir saplings and reproduction near Puyallup, Wash., were partially defoliated early in the spring. Later, aerial surveys failed to reveal any defoliated areas. Laboratory rearings of mature larvae failed to show the presence of any parasites. From experience, it is assumed that this is a local flareup that will soon subside.

Weevils

Sitka-Spruce Weevil
(Pissodes sitchensis Hopk.)

Reports of damage were received from many points in coastal Oregon. This type of damage is prevalent and relatively constant from year to year. Leader weeviling of young spruce increased 4 to 9 percent on permanent study plots at Cascade Head and in the Youngs River drainage. Research studies to test the weevil susceptibility of a number of spruce species and hybrids are now underway.

Bark Weevil
(Pissodes piperi Hopk.)

On a tree farm in the Mollala River drainage, weevils bred in a 90-year-old noble fir stand that had sustained rather extensive windbreak and snowbreak and began to attack surrounding green trees. Intermediate and suppressed trees were the preferred hosts. Current thinning operations are expected to improve the vigor of the reserve stand and minimize damage by the weevil.

Aphids

Spruce Aphid
(Aphis abietina (Wlkr.))

The severe outbreaks of this aphid that occurred in 1956 in coastal Oregon and Washington have been brought under control by natural factors, principally insect parasites. In 1957, one collection showed approximately 85 percent of the aphid population to be parasitized by braconid, chalcid, and cynipid wasps.

Seed and Cone Insects

Although no quantitative data are available, general indications are that a large part of the Douglas-fir, Sitka spruce, and ponderosa pine seed crop in 1958 was destroyed by insects. Damage of this type is increasingly important since more and more effort is going into the production and harvesting of tree seeds.

Range Insects

Insects reduce the amount of range forage available for livestock and wildlife. Just how important the insects are and how their damage can be checked have not been fully determined, but progress is being made in a cooperative study with Oregon State College. This study, begun in 1957 and continued in 1958, primarily concerns the insects attacking bitterbrush, an important winter browse plant for deer.

Of the many insects that attack bitterbrush, none was destructively epidemic in 1958. The Great Basin tent caterpillar (Malacosoma fragilis Stretch) was most conspicuously abundant, causing appreciable damage in Deschutes and Lake Counties, Oreg.

A 1957 outbreak of the bitterbrush looper (Anacamptodes sp.) near Boardman, Oreg., subsided after causing much damage.

OTHER FOREST PEST PROBLEMS

Dying Hemlock

Western hemlock mortality that first became evident in 1954 was greatly reduced in 1958 (table 14). Cause or causes of this mortality are unknown. The areas of heaviest losses were on the Mount Baker National Forest and in southwestern Washington. Data gathered from trend plots showed that the overall condition of hemlock stands remained good and that current losses were extremely low.

Table 14.--Trend of dying western hemlock in Oregon and Washington, 1954-58

(In acres)

Year of detection	Area of damage		Regional total
	Oregon	Washington[1/]	
1954	0	75,200	75,200
1955	11,680	57,120	68,800
1956	3,520	122,440	125,960
1957	640	245,760	246,400
1958	0	46,400	46,400

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

Bear Damage

Damage caused by bears declined for a third successive year, with the heaviest remaining centers on the Gifford Pinchot and Olympic National Forests and in southwestern Washington. Bears have killed and damaged many young conifers on extensive areas in western Oregon and western Washington since 1951 (table 15). Stands sustaining the most severe losses usually were those already understocked.

Table 15.--Trend of bear damage in western Oregon and western Washington, 1951-58

(In acres)

Year of detection	Western Oregon	Western Washington	Regional total
1951	0	208,800	208,800
1952	2,560	36,160	38,720
1953	18,080	118,240	136,320
1954	97,750	194,560	292,310
1955	120,800	173,760	294,560
1956	100,140	344,000	444,140
1957	101,920	103,040	204,960
1958	54,700	118,500	173,200

APPENDIX

Organization and Conduct of Surveys

Aerial Surveys

As in recent years, the regional aerial survey was a joint effort by four organizations: Oregon State Board of Forestry, Washington State Department of Natural Resources, Weyerhaeuser Timber Co., and the Pacific Northwest Forest and Range Experiment Station. Flying time totaled 262.7 hours (table 16). The bulk of the flying was done between July 7 and August 7, with some flights later in the season to detect balsam woolly aphid infestations in subalpine fir.

Flying in Washington was done in a plane contracted for by the Experiment Station. P. W. Orr, Experiment Station, and Kenneth Turnbull, Washington State Department of Natural Resources, acted as observers. Weyerhaeuser Timber Co. lands were surveyed by P. G. Lauterbach, observer, and R. Chapman, pilot, in a company plane.

In Oregon, the State Board of Forestry provided the services of A. T. Larsen, pilot, and 60 hours of flying time in a State-owned

plane. The Experiment Station contracted with the State for use of the plane and pilot for an additional 50 hours of flying time to complete the survey. W. J. Buckhorn and L. F. Pettinger were the observers in the State plane. Weyerhaeuser Timber Co. lands in Oregon were surveyed by P. G. Lauterbach and R. Chapman.

Table 16.--Summary of cooperative aerial survey activities in 1958

Area covered	Timbered area surveyed	Survey time		
		Mapping	Ferrying	Total
	M acres	----------	Hours	----------
Western Oregon	15,670	73.3	10.5	83.8
Eastern Oregon Cascades	6,591	16.3	1.1	17.4
Blue Mountains	6,964	25.8	3.6	29.4
Western Washington	11,774	72.0	3.9	75.9
Eastern Washington[1/]	7,148	53.5	2.7	56.2
All areas	48,147	240.9	21.8	262.7

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

In the two States, Weyerhaeuser Timber Co.'s total flying time amounted to about 50 hours. The Company survey was made according to previously agreed standards so it could be readily incorporated into the regional summary.

Ground Surveys

Aerial survey findings were ground checked by W. J. Buckhorn, P. W. Orr, L. F. Pettinger, R. Hunt, and J. Grunwald of the Experiment Station to verify the identity of the insects and the degree of infestation, and to determine the population trend. Oregon State Board of Forestry provided the services of E. Pearson for ground checking in Oregon.

An evaluation of the spruce budworm population in the egg stage was made on plots established in eastern Oregon by W. Klein, R. Hunt, and J. Grunwald under the direction of V. M. Carolin, Jr.

The detailed counts of the foliage samples were made under the direction of research personnel. A ground survey was made early in the season to determine the status of the budworm on the Willamette, Mount Hood, Gifford Pinchot, Snoqualmie, and Wenatchee National Forests--areas on which no epidemic infestation has been mapped in the past several years.

Data for the appraisal of the Douglas-fir beetle outbreak in southwestern Oregon were gathered by L. F. Pettinger, R. Hunt, and J. Grunwald of the Experiment Station, and E. Pearson of Oregon State Board of Forestry.

L. F. Pettinger and J. Grunwald assisted A. T. Burniskey, Bureau of Indian Affairs, in recruising several 320-acre pine beetle trend plots on the Warm Springs Indian Reservation.

Members of a committee of the Northwest Forest Pest Action Council and cooperators examined 275 trend plots to determine the status of the silver fir beetles and dying western hemlock.

Cooperators--private, State, and Federal--were asked to report abnormal activity by insects, diseases, and animals. A total of 106 reports disclosed 70 cases of insect damage, 12 cases of disease, and 24 cases of animal damage.

Table 17.--Extent of epidemic infestations in Oregon in 1958, by forest area, insect species, and intensity of infestation

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Deschutes N.F. and adjacent forest lands:						
Spruce budworm	1	2,080	0	0	0	2,080
Pandora moth	1	1,600	0	0	0	1,600
Balsam woolly aphid	4	2,080	0	0	0	2,080
Mt. pine beetle (L)	12	9,440	4,000	320	0	13,760
Mt. pine beetle (P)	2	1,760	0	0	0	1,760
Western pine beetle	6	3,840	0	0	0	3,840
All insects	26	20,800	4,000	320	0	25,120
Fremont N.F. and adjacent forest lands:						
Spruce budworm	4	38,880	0	0	0	38,880
Pine needle miner	1	160	0	0	0	160
Mt. pine beetle (L)	19	2,080	4,960	0	2,080	9,120
Mt. pine beetle (P)	1	0	480	0	0	480
Western pine beetle	12	3,360	160	0	0	3,520
Fir engraver	2	960	0	0	0	960
Oregon pine ips	5	320	0	160	0	480
All insects	44	45,760	5,600	160	2,080	53,600

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Malheur N.F. and adjacent forest lands:						
Spruce budworm	17	25,120	640	0	0	25,760
Douglas-fir beetle	5	640	0	0	0	640
Mt. pine beetle (L)	1	160	0	0	0	160
Western pine beetle	7	3,200	0	0	0	3,200
Fir engraver	3	480	0	0	0	480
Oregon pine ips	4	320	160	0	0	480
All insects	37	29,920	800	0	0	30,720
Mt. Hood N.F. and adjacent forest lands:						
Balsam woolly aphid	59	20,800	8,800	0	0	29,600
Douglas-fir beetle	15	4,640	2,880	0	0	7,520
Mt. pine beetle (W)	13	5,600	1,440	0	0	7,040
Western pine beetle	7	4,640	0	0	0	4,640
Oregon pine ips	2	160	0	320	0	480
All insects	96	35,840	13,120	320	0	49,280

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Ochoco N.F. and adjacent forest lands:						
Spruce budworm	1	6,400	0	0	0	6,400
Douglas-fir beetle	1	320	0	0	0	320
Western pine beetle	22	18,400	27,520	8,320	0	54,240
Oregon pine ips	4	480	160	0	0	640
All insects	28	25,600	27,680	8,320	0	61,600
Rogue River N.F. and adjacent forest lands:						
Douglas-fir beetle	121	108,160	38,080	15,520	4,480	166,240
Mt. pine beetle (L)	6	1,920	0	1,280	480	3,680
Western pine beetle	6	800	160	0	0	960
Fir engraver	3	400	0	0	0	400
Oregon pine ips	10	160	800	960	0	1,920
All insects	146	111,440	39,040	17,760	4,960	173,200
Siskiyou N.F. and adjacent forest lands:						
Douglas-fir beetle	195	172,480	40,960	6,240	1,440	221,120
Western pine beetle	2	320	0	0	0	320
Oregon pine ips	1	0	0	160	0	160
All insects	198	172,800	40,960	6,400	1,440	221,600

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Siuslaw N.F. and adjacent forest lands:						
Spruce bud moth	13	3,200	800	0	0	4,000
Balsam woolly aphid	1	7,520	10,560	480	0	18,560
Douglas-fir beetle	108	110,880	23,840	5,760	0	140,480
All insects	122	121,600	35,200	6,240	0	163,040
Umatilla N.F. and adjacent forest lands:						
Douglas-fir beetle	28	7,200	6,880	0	0	14,080
Mt. pine beetle (L)	2	320	0	0	0	320
Western pine beetle	2	800	0	0	0	800
Engelmann spruce beetle	5	1,920	1,120	0	0	3,040
Fir engraver	8	4,640	320	0	0	4,960
Oregon pine ips	5	480	800	0	0	1,280
All insects	50	15,360	9,120	0	0	24,480
Umpqua N.F. and adjacent forest lands:						
Balsam woolly aphid	2	2,240	0	0	0	2,240
Douglas-fir beetle	167	175,680	106,400	34,240	1,920	318,240
Mt. pine beetle (W)	9	1,120	0	0	0	1,120
All insects	178	179,040	106,400	34,240	1,920	321,600

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Wallowa-Whitman N.F. and adjacent forest lands:						
Spruce budworm	58	167,360	58,560	14,400	0	240,320
Douglas-fir beetle	11	1,920	2,400	0	0	4,320
Mt. pine beetle (L)	4	640	0	0	0	640
Western pine beetle	2	320	0	0	0	320
Engelmann spruce beetle	4	1,120	480	0	0	1,600
Fir engraver	18	3,200	800	160	0	4,160
Oregon pine ips	12	1,600	640	0	0	2,240
All insects	109	176,160	62,880	14,560	0	253,600
Willamette N.F. and adjacent forest lands:						
Lodgepole pine sawfly	1	320	0	0	0	320
Balsam woolly aphid	41	42,880	12,640	0	0	55,520
Douglas-fir beetle	16	6,240	160	0	0	6,400
Mt. pine beetle (W)	45	13,920	9,120	960	0	24,000
All insects	103	63,360	21,920	960	0	86,240
Crater Lake N.P.:						
Mt. pine beetle (L)	1	0	960	0	0	960
Fir engraver	1	160	0	0	0	160
All insects	2	160	960	0	0	1,120

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

Administrative area and insects involved[1/] [2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Klamath I.R.:						
Mt. pine beetle (L)	11	5,280	800	960	0	7,040
Mt. pine beetle (P)	1	320	0	0	0	320
Western pine beetle	1	640	0	0	0	640
All insects	13	6,240	800	960	0	8,000
Warm Springs I.R.:						
Balsam woolly aphid	5	2,080	480	0	0	2,560
Douglas-fir beetle	1	160	0	0	0	160
Mt. pine beetle (L)	2	800	160	0	0	960
Western pine beetle	11	22,240	1,920	0	0	24,160
All insects	19	25,280	2,560	0	0	27,840
Northwest Oregon (O.S.B.F.):						
Spruce bud moth	1	800	0	0	0	800
Douglas-fir beetle	4	640	0	0	0	640
All insects	5	1,440	0	0	0	1,440
Lookout Mountain (B.L.M.):						
Spruce budworm	3	0	0	2,000	0	2,000

1/ Mountain pine beetle damage has been separated by tree species attacked: L, lodgepole pine; W, western white pine; P, ponderosa pine.

2/ Administrative areas are abbreviated as follows: N.F., national forest; N.P., national park; I.R., Indian reservation; O.S.B.F., Oregon State Board of Forestry; B.L.M., Bureau of Land Management.

Table 18.--Extent of epidemic infestations in Washington in 1958, by forest area, insect species, and intensity of infestation[1/]

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Gifford Pinchot N.F. and adjacent forest lands:						
Balsam woolly aphid	56	72,290	34,010	15,140	4,960	126,400
Douglas-fir beetle	7	1,440	0	0	0	1,440
Mt. pine beetle (W)	87	17,760	19,040	20,160	2,720	59,680
Western pine beetle	3	5,920	0	0	0	5,920
All insects	153	97,410	53,050	35,300	7,680	193,440
Mt. Baker N.F. and adjacent forest lands:						
Douglas-fir beetle	2	320	0	0	0	320
Mt. pine beetle (W)	98	13,280	11,680	4,320	0	29,280
Engelmann spruce beetle	2	320	0	0	0	320
Fir engraver	5	800	320	0	0	1,120
Silver fir beetles	18	2,800	0	0	0	2,800
All insects	125	17,520	12,000	4,320	0	33,840

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Okanogan N.F. and adjacent forest lands:						
Douglas-fir beetle	22	8,320	800	0	0	9,120
Mt. pine beetle (L)	2	0	640	0	0	640
Western pine beetle	25	5,440	1,440	160	0	7,040
Fir engraver	13	2,240	1,280	0	0	3,520
Oregon pine ips	2	480	0	0	0	480
All insects	64	16,480	4,160	160	0	20,800
Olympic N.F. and adjacent forest lands:						
Spruce bud moth	1	480	0	0	0	480
Douglas-fir beetle	1	160	0	0	0	160
Mt. pine beetle (W)	72	17,280	4,480	320	0	22,080
Fir engraver	1	0	160	0	0	160
Silver fir beetles	3	640	0	0	0	640
All insects	78	18,560	4,640	320	0	23,520

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Snoqualmie N.F. and adjacent forest lands:						
Larch bud moth	24	9,600	6,720	0	0	16,320
Black-headed budworm	2	960	0	0	0	960
Balsam woolly aphid	8	6,080	0	0	0	6,080
Douglas-fir beetle	2	960	0	0	0	960
Mt. pine beetle (W)	89	18,080	13,280	1,920	0	33,280
Engelmann spruce beetle	4	160	640	0	0	800
Fir engraver	5	960	320	0	0	1,280
Silver fir beetles	4	1,280	0	0	0	1,280
All insects	138	38,080	20,960	1,920	0	60,960
Umatilla N.F. and adjacent forest lands:						
Douglas-fir beetle	7	4,160	0	0	0	4,160
Mt. pine beetle (L)	1	0	1,600	0	0	1,600
Western pine beetle	1	160	0	0	0	160
Engelmann spruce beetle	2	800	0	0	0	800
Oregon pine ips	1	160	0	0	0	160
All insects	12	5,280	1,600	0	0	6,880

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Wenatchee N.F. and adjacent forest lands:						
Larch bud moth	7	6,240	6,400	800	0	13,440
Black-headed budworm	7	640	1,120	0	0	1,760
Balsam woolly aphid	1	480	0	0	0	480
Pine needle scale	6	0	0	9,760	0	9,760
Douglas-fir beetle	26	3,520	2,560	160	0	6,240
Mt. pine beetle (L)	6	1,760	960	320	0	3,040
Mt. pine beetle (W)	51	6,080	6,560	2,720	0	15,360
Western pine beetle	17	3,680	0	0	0	3,680
Engelmann spruce beetle	6	1,600	320	0	0	1,920
Fir engraver	18	2,240	2,080	0	0	4,320
Oregon pine ips	3	640	320	0	0	960
All insects	148	26,880	20,320	13,760	0	60,960
Mt. Rainier N.P.:						
Mt. pine beetle (W)	6	1,600	320	0	0	1,920
Olympic N.P.:						
Mt. pine beetle (W)	78	16,800	8,000	0	0	24,800
Fir engraver	2	0	160	0	0	160
All insects	80	16,800	8,160	0	0	24,960

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Colville I.R.:						
Larch bud moth	7	960	3,840	480	0	5,280
Pine needle scale	1	640	0	0	0	640
Douglas-fir beetle	50	8,120	19,040	1,600	0	28,760
Mt. pine beetle (L)	1	480	0	0	0	480
Western pine beetle	6	4,000	0	0	0	4,000
Fir engraver	1	0	160	0	0	160
Oregon pine ips	5	960	160	0	0	1,120
All insects	71	15,160	23,200	2,080	0	40,440
Quinault I.R.:						
Mt. pine beetle (W)	5	4,480	0	0	0	4,480
Yakima I.R.:						
Larch bud moth	7	6,400	480	0	0	6,880
Douglas-fir beetle	1	160	0	0	0	160
Mt. pine beetle (L)	1	160	0	0	0	160
Western pine beetle	26	19,840	4,000	0	0	23,840
Fir engraver	1	0	160	0	0	160
All insects	36	26,560	4,640	0	0	31,200

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Spokane I.R.:						
Western pine beetle	5	2,880	1,760	1,760	0	6,400
Oregon pine ips	4	360	0	80	0	440
All insects	9	3,240	1,760	1,840	0	6,840
Glenwood District (W.S.D.N.R.):						
Western pine beetle	8	3,880	1,160	0	0	5,040
Oregon pine ips	1	160	0	0	0	160
All insects	9	4,040	1,160	0	0	5,200
Southwest Washington (W.S.D.N.R.):						
Balsam woolly aphid	10	12,480	320	0	0	12,800

1/ All of Washington except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

2/ Mountain pine beetle damage has been separated by tree species attacked: L, lodgepole pine; W, western white pine.

3/ Administrative areas are abbreviated as follows: N.F., national forest; I.R., Indian reservation; N.P., national park; W.S.D.N.R., Washington State Department of Natural Resources.

DOMINION OF CANADA

PACIFIC OCEAN

IDAHO

CALIFORNIA

FIGURE 2

SPRUCE BUDWORM SITUATION IN OREGON AND WASHINGTON

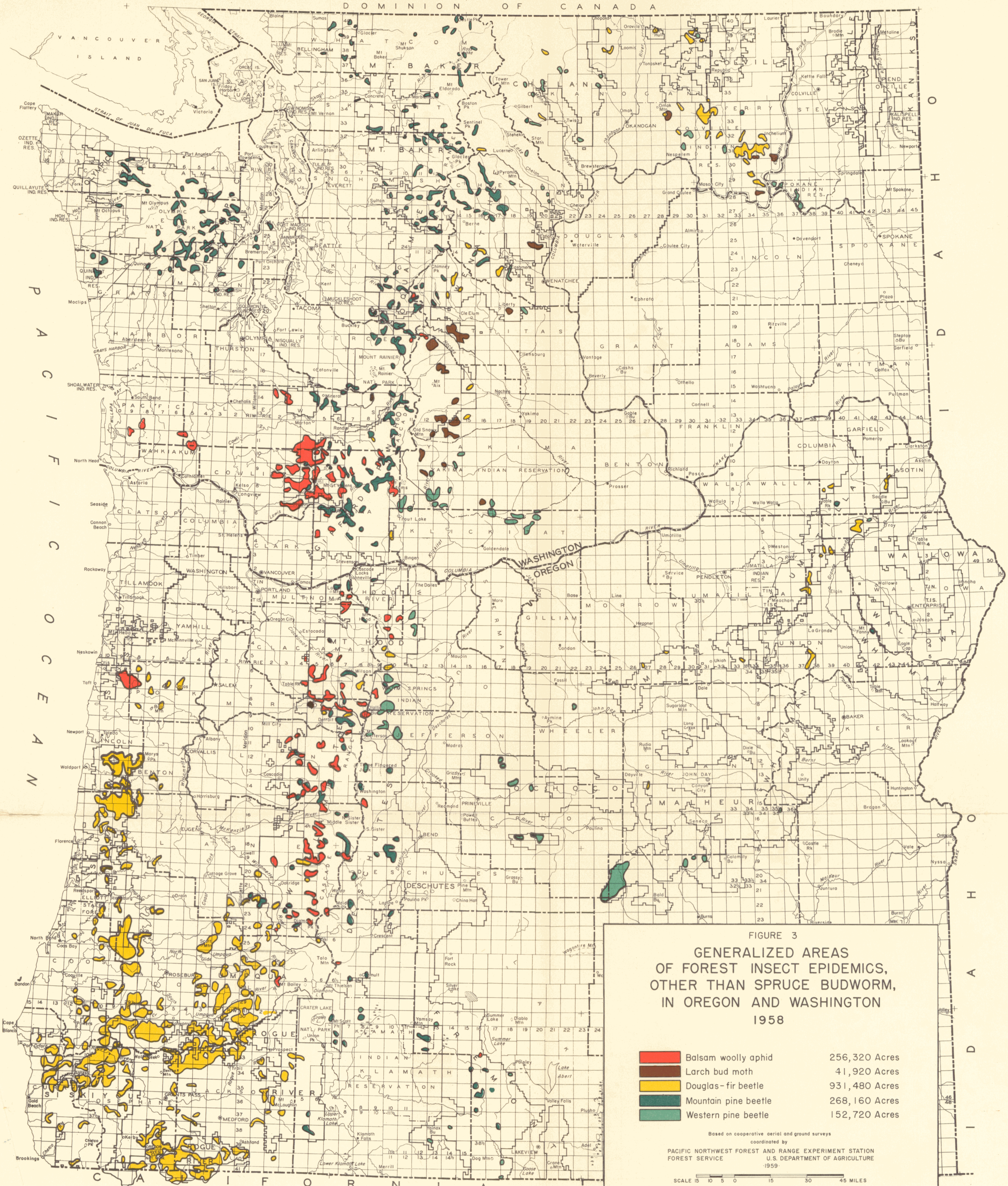
1958

Light Infestation	239,840 Acres
Moderate Infestation	59,200 Acres
Heavy Infestation	16,400 Acres
Aerial spraying project 1958	818,050 Acres
Aerial spraying project 1949-1955	3,839,611 Acres

FLY CREEK Control Unit Boundary and Name

Based on cooperative aerial and ground surveys
coordinated by
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE U. S. DEPARTMENT OF AGRICULTURE
1959

Scale: 15 10 5 0 15 30 45 MILES


DOMINION OF CANADA
PACIFIC OCEAN
IDAHO
CALIFORNIA
VANCOUVER ISLAND
STRAIT OF JUAN DE FUCA
GEORGIA STRAIT
WASHINGTON
OREGON
Blaine
Sumas
BELLINGHAM
LUMMI IND. RES.
ORCAS IS.
SAN JUAN IS.
Friday Harbor
Victoria
Cape Flattery
MAKAH IND. RES.
OZETTE IND. RES.
QUILLAYUTE IND. RES.
HOH IND. RES.
Port Angeles
Port Townsend
Coupeville
WHIDBEY IS.
CAMANO IS.
Arlington
EVERETT
TULALIP IND. RES.
SWINOMISH IND. RES.
Mt Vernon
Sedro Woolley
Sumas
Glacier
Mt Shuksan
Mt Baker
Concrete
Marblemount
Mt Eldorado
Tower Mtn
Boston Pk
Sentinel Pk
Gilbert
Twisp
Stehekin
Star Mtn
Lucerne
Pyramid Mtn
Glacier Pk
Sulton
Berne
Brewster
Chopaka
Oroville
Loomis
Tonasket
Omak
Omak Mtn
OKANOGAN
Nespelem
Grand Coulee
Mason City
Coulee City
Waterville
Ephrata
Almira
Davenport
Inchelium
Kettle Falls
COLVILLE
Republic
Curlew
Laurier
Boundary
Brodie Mtn
Metaline
Newport
Springdale
Mt Spokane
SPOKANE
Cheney
Plaza
Ritzville
Colfax
Pullman
Garfield
Clarkston
Asotin
Dayton
Pomeroy
Waitsburg
Walla Walla
Wallula
Pasco
Richland
Prosser
Kennewick
Yakima
Ellensburg
Vantage
Cashs Bu
Beverly
Othello
Connell
Washtucna
Naches
Old Snowy Mtn
Gable Bu
Goldendale
Trout Lake
Mt St Helens
Longview
Kelso
Cathlamet
Astoria
Seaside
Cannon Beach
Rockaway
Timber
Tillamook
Hillsboro
Forest Grove
Banks
Vernonia
Scappoose
St Helens
Rainier
Clatskanie
Columbia City
Deer Island
Warren
Scappoose
Sauvie Island
Portland
Vancouver
Camas
Washougal
Stevenson
Cascade Locks
Bonneville
Hood River
The Dalles
Dufur
Tygh Valley
Maupin
Condon
Fossil
Heppner
Moro
Grass Valley
Madras
Metolius
Culver
Sisters
Redmond
Powell Buttes
Prineville
Paulina
Bend
Lapine
Paulina Pk
China Hat
Pine Mtn
Grassy Bu
Three Fingered Jk
Mt Washington
Cascadia
Grizzly Mtn
Dayville
John Day
Canyon City
Unity
Burnt River
Huntington
Brogan
Halfway
Baker
Sumpter
Granite
Bates
Whitney
Richland
Juntura
Bald Bu
Burns
Riverside
Burnt Mtn
Lookout Mtn
Nyssa
Ontario
Vale
Castle Rk
Calamity Bu
Seneca
Malheur
Table Mtn
Troy
Weston
Pendleton
Umatilla
Meacham
La Grande
Elgin
Wallowa
Enterprise
Joseph
Eagle Cap
Mt Fanny
Union
Ukiah
Dale
Sugarloaf Mtn
Long Creek
Table Mtn
Saddle Bu
Table Rk
Asotin
Clarkston
Pomeroy
Garfield
Colfax
Pullman
Moscow
Palouse
Genesee
Potlatch
Troy
Weston
Umatilla
Pendleton
Service Bu
Meacham
La Grande
Elgin
Wallowa
Enterprise
Joseph
Eagle Cap
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